Part for supporting an item of equipment, comprising support ribs, and method of molding said part

FIELD OF THE INVENTION

The invention relates to a support part for holding an item of equipment, in particular an item of equipment for a motor vehicle, comprising a casing of molded plastic having a peripheral wall on which support ribs are provided for holding the item of equipment, the peripheral wall defining a housing of given axis for receiving the item of equipment.

BACKGROUND AND SUMMARY OF THE INVENTION

Furthermore, the invention relates to a method of molding a support part having support ribs for holding an item of equipment, in particular an item of equipment for a motor vehicle, comprising the steps consisting in:

- providing a mold consisting of at least two cores;
- bringing the two cores toward one another in a given direction, such that they are in contact with one another along a parting plane;
- filling the mold with a moldale material; and
- moving the cores apart from one another in the given direction.

The invention relates more particularly to support parts manufactured in industry, for example parts for supporting items of equipment for a motor vehicle, such as electric motors driving a blower and intended for a motor vehicle heating-ventilating and/or air-conditioning apparatus or alternatively for a motorized fan unit arranged behind a radiator for cooling the engine of the motor vehicle. These parts frequently consist of a cylindrical casing of molded plastic having, on the inside, a series of support ribs for

holding the item of equipment, for example the electric motor.

To ensure that the item of equipment is held firmly, it is necessary for the inside diameter defined by the ends of the ribs to be greater than the outside diameter of the supported item of equipment. It is additionally necessary for there to be clamping or negative clearance between the outside diameter of the item of equipment and the ribs.

On account of the fact that the support parts are obtained by molding, it is necessary to provide a draft angle for the mold to allow the part to be withdrawn from the mold. This draft is found on the ribs, which consequently have a variation in diameter from one end to the other. This variation in diameter depends, on the one hand, on the draft angle and, on the other hand, on the length of the part. The larger the draft angle and the longer the part, the greater the variation in diameter.

To ensure that the item of equipment is correctly held at each of its two ends, it is consequently necessary for there to be clamping at the more flared end of the ribs. It is therefore necessary, as stated above, for the outside diameter of the item of equipment to be supported, for example the electric motor, to be greater than the diameter defined by the ends of the ribs at the end where these ribs have the greatest diameter. It goes without saying that, at the other end, that is to say at the end where the diameter of the ribs is tightest, clamping is greater still.

This variation in clamping has several drawbacks. First of all the item of equipment is not held uniformly over its whole length. The item of equipment is held better at one end than at the other. Moreover, in one end portion of the support part, there is a first

manufacturing tolerance, whereas in another end portion, there is a second manufacturing tolerance which is different from the first. This results in an overall tolerance that is the sum of the two aforementioned tolerances and is therefore much too wide, sometimes leading to a situation where it is impossible to mount the item of equipment in the support part.

It is for this reason that attempts have been made to reduce as far as possible the difference in diameter between the two ends of the ribs of the support parts that are currently known. In the prior art, this result is currently achieved by reducing the draft angle. However, it is not possible in practice to drop below a draft angle of less than 1°. By way of example, a draft angle for a length of 55 mm represents a variation of 0.96 mm in the radius of the rib.

Moreover, it is known to place the parting plane of the two cores at the center of the part so as to halve the influence of the length of the ribs. This method makes it possible to reduce the variations in the diameter of the ribs by a factor of two. The drawbacks mentioned above are lessened but nevertheless remain.

The invention aims to eliminate these drawbacks by producing a support part having draft-free ribs.

Moreover, it concerns a method of molding the support part, and also a mold for implementing this method.

To this end, the invention provides a support part for holding an item of equipment, in particular an item of equipment for a motor vehicle, of the type defined above, in which the ribs are inclined with respect to the axis of the reception housing.

By virtue of these features, the ribs have a zero draft angle. The diameter of the circle defined by the ends of the ribs is constant from one end of the molded part to the other. Clamping of the supported item of equipment is constant over its whole length, the item of equipment therefore being held better. In addition, it is not necessary to increase the clamping at one end in order for the item of equipment to be held at the other end. The manufacturing tolerances are therefore more reliable, without possible spread. The vibration of the item of equipment, when it is a motor, is thus better tolerated and does not cause the item of equipment to become uncoupled from its support.

It should be noted that the peripheral wall of the support part, on which wall the ribs are provided, has a non-zero draft. However, this in no way constitutes a drawback because the supported item of equipment is not in contact with it.

According to another feature of the invention, the ribs are formed on the inside of the casing and they each have a salient edge that is able to make contact with the item of equipment.

Advantageously, the ribs are grouped in pairs having opposite inclinations. This feature makes it easier to remove the cores from the mold. The number of ribs is advantageously between 4 and 12.

In one specific embodiment, the ribs have the shape of a helix. Their draft is then strictly equal to zero. In another specific embodiment, the ribs have the shape of a straight line segment connecting two points situated on a helix. The draft is then not strictly zero, but it is negligible. The angle of inclination of the helix is preferably between 1° and 15°.

The shape of the ribs corresponds above all to the shape of a salient edge that the rib has. In fact, it is this salient edge that comes into contact with the item of equipment that is housed in the support part. The ribs may have a cross section selected from the group comprising triangular, square, rectangular, semi-circular or elliptical shapes, or a combination of these shapes.

The cross section of the ribs may be constant, increasing or decreasing. It is also possible to combine these various possibilities.

In one specific embodiment, the ribs are continuous.

In another specific embodiment, the ribs are formed by a succession of bosses arranged along a line that is inclined with respect to the axis of the housing.

In this case, the bosses may be arranged along a helical line or, alternatively, along a straight line segment connecting two points situated on a helix. In all cases, it is advantageous for the bosses to have points of contact defining salient edges of the ribs.

The invention also concerns a method of molding a support part as defined above, in which the support ribs are provided on the molded part with an inclination with respect to the given direction, in which the cores are shaped such that their parting plane follows the ribs, and in which a clearance is provided in at least one of the cores in the region of their parting plane in order to form the ribs, during molding, by the filling of this clearance with molded material.

Advantageously, the cores are shaped such that their parting plane forms salient edges of the ribs.

In order to implement the method, use is advantageously made of an upper core having a cylindrical central portion and peripheral protrusions, and a lower core having a cylindrical central portion and peripheral protrusions.

Each peripheral protrusion of the upper core has an outer cylindrical face, an inner cylindrical face and radial faces connecting the outer cylindrical face and the outer cylindrical face, whereas each peripheral protrusion of the lower core has an outer cylindrical face, an inner cylindrical face and radial faces connecting the outer and inner cylindrical faces.

The radial faces may be, in particular, planar or helical.

Advantageously, the mold comprises a clearance in at least one of the cores in the region of their parting plane in order to form the ribs during molding.

This clearance is preferably formed by a connecting face connecting an outer cylindrical face and a radial face of the upper core and/or by a connecting face connecting an outer cylindrical face and a radial face of the lower core.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will also become apparent on reading the following description of exemplary embodiments given by way of illustration with reference to the appended drawings, in which:

figure 1 is a perspective view of a part produced according to the invention for supporting an item of equipment, in this example an electric motor;

figure 2 is a plan view of the support part depicted in Figure 1;

figure 3 is a view in section on III-III of the support part of figure 1;

figure 4 is a three-dimensional diagram illustrating the inclination of the support ribs, with respect to the axis of rotation, of a support part produced according to the invention;

figure 5 is a three-dimensional diagram depicting a pair of associated ribs;

figures 6 and 7 are perspective views depicting two positions of the cores used in the method of the invention;

figure 8 is a plan view of the cores depicted in figures 6 and 7;

figure 9 is an enlarged detail of figure 8;

figure 10 is a partial perspective view of another embodiment of a support part molded according to the invention; and

figure 11 is a partial view in section of a support part, a rib of which is in contact with an item of equipment housed in the support part.

DETAILED DESCRIPTION OF THE PREFFERED EMBODIMENTS

Figure 1 shows a perspective view of a support casing 2 for an electric motor. The casing 2 is a molded part obtained by molding a plastic, for example a polypropylene, a talc-filled polypropylene, a polyurethane, or a polyoxymethylene. The support part 2 has a peripheral wall 4 (or skirt) of axis X-X (see figures 2 and 3) that bounds an open housing that is

able to receive an electric motor (not shown). In the example, three ledges 6 arranged respectively at 120° to one another (figure 2) enable the electric motor to be retained in the housing. However, the number of ledges is not restricted to this value and could be greater than three. On the outside, the peripheral wall 4 has three tabs 8 arranged at 120° to one another, and a stud 10 on each of these tabs. This enables the casing 2 to be fixed to the chassis of a motor vehicle.

This electric motor is, for example, a motor intended for the motorized fan unit that is fitted in a motor vehicle heating-ventilating/air-conditioning installation.

Three support grooves 12 formed at 120° to one another in the peripheral wall 4 enable the support to be uncoupled from the remainder of the installation. Three clips 14 arranged between the grooves 12 retain the electric motor after it has been put in place. Ribs 16 and 18 are formed on the inside on the peripheral wall 4. As can be seen in figure 2, which is a plan view of the support part depicted in figure 1, the number of these ribs is in this case six, namely three ribs 16 and three ribs 18. Generally, it is possible to have from two pairs to six pairs of ribs, i.e. from four to twelve ribs. The ribs 16 are inscribed in a right-handed helix, whereas the ribs 18 are inscribed in a left-handed helix. The inclinations of the ribs 16 and 18 with respect to the axis of rotational symmetry X-X of the casing 2 are therefore opposite. Consequently, the ribs are grouped in pairs (one rib 16 and one rib 18) of opposite inclinations.

An area 20 in the form of an isosceles trapezoid that widens progressively downward (as shown in figure 3) is thus bounded between two ribs 16 and 18. In the same way, areas 22 in the form of isosceles trapezoids that widen progressively upward are bounded, on the peripheral wall 4, between the ribs 16 and 18 of two

neighboring pairs of ribs. These trapezoidal areas 20 and 22 have a draft angle to allow them to be removed from the mold.

Figure 4 depicts a view in space that shows the inclination of the ribs 16, 18 with respect to the longitudinal axis X-X of the peripheral wall 4. The circle 24 schematically represents the diameter of the peripheral wall. The axis X-X is perpendicular to the plane of the circle 24 and it passes through the center of this circle. The straight line 26 is parallel to the axis X-X and it intersects the circle 24 at a point 28. The straight line 30 is tangential to the helix 32 of axis X-X. It makes an angle α with the straight line 26.

The ribs 16 and 18 may advantageously have a helical shape and they each have a salient edge intended to come into contact with the item of equipment, in this case the shell of the electric motor. In other words, each of the salient edges of the ribs 16 and 18 consists of a segment of a helix 32 having an angle of inclination α with the parallel 26 to the axis X-X of the peripheral wall of the molded part. Of course, the direction of the helices is different. The helix depicted in figure 4 is a right helix that corresponds to the ribs 16. The salient edges of the ribs 18 follow the profile of an identical helix, preferably having (although this is not essential) the same inclination α but the opposite direction (left helix). Two oppositely directed helices 16 and 18 are thus grouped in pairs as depicted in figure 5.

In another embodiment of the method of the invention, the salient edges of the ribs 16 and 18 consist of a straight line segment 35 connecting two points 34 and 36 situated on the helix 32. This embodiment is simpler because the ribs are then rectilinear. The shape of the base of the ribs is not decisive as long as it is not

detrimental to the support part's being removed from the mold. What is important here is the shape of the salient edge of the rib, which may be pointed to a greater or lesser extent.

Figures 6 and 7 illustrate the molding method of the invention. In this method, use is made of a mold consisting of two cores, namely an upper core 38 and a lower core 40. The cores 38 and 40 are depicted in part in figures 6 and 7. The upper core 38 has a cylindrical portion 42 and the lower core 40 has a cylindrical portion 44. Peripheral protrusions 46 are attached to the cylindrical central portion 42 of the upper core 38, and peripheral protrusions 48 are attached to the cylindrical central portion 44 of the lower core 40. In the example, there are three protrusions for each of the cores, but this number could be lower or higher.

The protrusions 46 of the upper core 38 have an outer cylindrical face 50 and an inner cylindrical face 54 and radial faces 58 that connect the outer cylindrical face 50 and inner cylindrical face 54.

The peripheral protrusions 48 of the lower core 40 have an outer cylindrical face 52 and an inner cylindrical face 56 and radial faces 60 that connect the outer cylindrical faces 52 and inner cylindrical faces 56.

The radial faces 58 and 60 are inclined with respect to the axis X-X of the part to be molded by an angle α equal to the angle of inclination of the ribs. They may be planar or helical. More precisely, what is being referred to here is the area of connection between the outer cylindrical wall and the radial wall of each protrusion, as will be seen later.

As can be seen in figure 6, and also in figure 8, which depicts a plan view of the cores, the shapes of the cores 38 and 40 are designed so that they fit into one

another. In other words, the three peripheral protrusions 46 of the upper core and the three peripheral protrusions 48 of the lower core fit into one another perfectly, their radial faces coming into contact with one another so as to reconstitute a complete cylinder without there being any play between these faces, except within the rib-molding areas. Since the angles of inclination of the faces are identical, these faces are in perfect contact with one another and form a parting plane for the cores, except within the rib-molding areas.

As can be seen in figure 8 and more particularly in figure 9, clearances 62 are formed in the peripheral protrusions 46 and 48. These clearances 62 are each formed by a connecting face connecting an outer cylindrical face 50 and a radial face 58 of a protrusion 46 of the upper core 38 or by a connecting face connecting an outer cylindrical face 52 and a radial face 60 of a protrusion 48 of the lower core 60. As an alternative, it is possible for these clearances to be provided on only one of the cores. These clearances leave a gap that will be filled by the molded material at the time of molding so as to form the ribs 16 and 18. Of course, the shape of the clearances 62 corresponds to the shape of the ribs that it is desired to obtain.

In the example shown, the clearances 62 bound a volume of triangular cross section such that, after molding, the ribs will have a corresponding shape, that is to say a triangular cross section. If it is desired to obtain another rib shape, for example a semi-circular or elliptical, etc., shape, the shape of the clearances 62 must be tailored to this profile.

Since the ribs 16 and 18 are arranged along the parting plane, it will be understood that it is not necessary to design in a draft angle. The upper core 38 and the

lower core 40 separate from one another while releasing from the ribs. The angle of inclination of the radial planar faces 58 and 62, for example between 1° and 15°, naturally facilitates removal from the mold.

When the salient edges of the ribs have a helical shape that follows the profile of the helix 32 (figure 4), the draft angle is completely zero. When, by contrast, the radial faces are rectilinear, there is a small space between the profile of the helix and the straight line segment 35. There is then a very small draft. For example, for a radius of 32.5 mm and an angle α of 7° and a length of 50 mm for the ribs 16 and 18, the maximum variation in the circle defined by the ends of the ribs 16 and 18 is less than 0.15 mm over the radius of this circle.

However, the use of a circular or square cross section generates a very small draft angle of the planar surface described by the cross section along the helix. The draft angle applies in a direction D in which the cores are brought toward one another or moved apart from one another, which limits the effect of the draft angle.

Prior to molding, the cores 38 and 40 forming the mold are brought toward one another in the direction D, which coincides with the longitudinal axis X-X of the support part to be molded. After molding, the cores are moved apart from one another in the same direction D as schematically represented by the arrows 53 and 55 (figures 6 and 7).

Figure 10 depicts an alternative embodiment of the method and of the part obtained by the method. In this embodiment, the peripheral wall 4 of the part to be molded does not have continuous ribs, as in the preceding embodiment, but a series of bosses 64 forming a discontinuous rib. The bosses 64 are arranged along

the parting plane between the upper and lower cores, in a similar manner to the ribs of the preceding embodiment. They are produced by molding, by filling molded plastic into cutouts (not shown) formed in the peripheral protrusions 46 and 48. It goes without saying that the shape of these cutouts (not shown) corresponds to the shape of the bosses 64 that it is desired to obtain.

In the same way as for the ribs, the bosses 64 may have a wide variety of profiles as long as they provide points of contact that can form the salient edges of the ribs. These bosses may have a triangular, square, rectangular, elliptical or semi-circular cross section or a combination of these shapes. Their rectangular cross section preferably has a length of 10 mm and a width of 5 mm.

The bosses 64 may be arranged exactly along the profile of the helix 32 (figure 4), or else they may be arranged along a rectilinear straight line segment 35 joining two points of the helix. However, the arrangement of the bosses must be designed so as to make molding possible, which rules out the superposition of demolding areas. The length of the bosses is preferably below 10 mm. This length makes it possible to retain a slight variation in the radius of the circle defined by their ends.

In the example shown, the bosses 64 are teardrop-shaped, which is advantageous for removal from the mold. Also depicted in figure 10 is an alternative form of a boss 66 having a semi-circular cross section and two rounded ends. All these forms make it possible to provide continuous and constant clamping of the electric motor while generating a slight variation in the diameter of the circle defined by the end of the bosses.

Figure 11 shows a rib 16 of triangular cross section having a salient edge 68 and an opposite base that is attached to the cylindrical wall 4 of the support part 2. The salient edge 68 comes into contact with an item of equipment 70, in this case the shell of an electric motor.

WHAT IS CLAIMED IS: